

Claims

[c1] What is claimed is:

1. A method for enhancing video image data, the method comprising the following steps:

- (a)inputting image data having a plurality of pixels;
- (b)providing a first gray level range and a second gray level range; according to the plurality of pixels in the image data being within the first gray level range, generating a first mean gray level, a first minimum gray level, a first maximum gray level; and according to the plurality of pixels in the image data being within the second gray level range, generating a second mean gray level, a second minimum gray level, and a second maximum gray level; wherein the boundary between the first gray level range and the second gray level range is a first threshold;
- (c)according to the first threshold, generating a second threshold; according to the second threshold, the first mean gray level, the first minimum gray level, and the first maximum gray level, generating a third mean gray level; and according to the second threshold, the second mean gray level, the second minimum gray level, and the second maximum gray level, generating a fourth mean

gray level;

(d) according to the third mean gray level, the first mean gray level, and the first minimum gray level, generating a first gain value; and according to the fourth mean gray level, the second mean gray level, the second minimum gray level, generating a second gain value; and

(e) according to the first mean gray level, the first gain value, the third mean gray level, the second mean gray level, the second gain value, and the fourth mean gray level, generating adjusted image data gray levels for the first gray level range and the second gray level range.

[c2] 2. The method of claim 1, wherein step (b) further comprises according to the first threshold, generating a first pixel count being the total number of image data pixels being between gray level 0 and the first threshold, and generating a second pixel count being the total number of image data pixels being between the first threshold and gray level 255; wherein the first mean gray level is the average gray level of the first pixel count, and the second mean gray level is the average gray level of the second pixel count.

[c3] 3. The method of claim 1, further comprising providing a cutoff percentage; wherein the first minimum gray level, the first maximum gray level, the second minimum gray level, and the second maximum gray level are generated

also according to the cutoff percentage.

[c4] 4.The method of claim 3, wherein in step (b), the first minimum gray level is the gray level of the n^{th} pixel when accumulating the pixels in order of increasing gray levels starting at gray level 0, n being equal to the cutoff percentage multiplied by the total number of pixels; the first maximum gray level is the gray level of the n^{th} pixel when accumulating the pixels in order of decreasing gray levels starting at the first threshold, n being equal to the cutoff percentage multiplied by the total number of pixels; the second minimum gray level is the gray level of the n^{th} pixel when accumulating the pixels in order of increasing gray levels starting at the first threshold, n being equal to the cutoff percentage multiplied by the total number of pixels; and the second maximum gray level is the gray level of the n^{th} pixel when accumulating the pixels in order of decreasing gray levels starting at gray level 255, n being equal to the cutoff percentage multiplied by the total number of pixels.

[c5] 5.The method of claim 1, wherein step (c) further comprises providing a tolerance value; if the difference between the first pixel count and the second pixel count is less than the tolerance value, setting the second threshold equal to the first threshold; if the difference when the second pixel count is subtracted from the first pixel

count exceeds the tolerance value, setting the second threshold to the gray level of the n^{th} pixel when accumulating the pixels in order of increasing gray levels starting at the first threshold, wherein n is equal to the cutoff percentage multiplied by the total number of pixels; and if the difference when the first pixel count is subtracted from the second pixel count exceeds the tolerance value, setting the second threshold to the gray level of the n^{th} pixel when accumulating the pixels in order of decreasing gray levels starting at the first threshold, wherein n is equal to the cutoff percentage multiplied by the total number of pixels.

[c6] 6. The method of claim 4, wherein in step (c), the third mean gray level is:
$$\frac{(\text{the second threshold}) * (\text{the first mean gray level the first minimum gray level})}{(\text{the first maximum gray level the first minimum gray level})};$$
 and the fourth mean gray level is:
$$\frac{(255 - \text{the second threshold}) * (\text{the second mean gray level the second minimum gray level})}{(\text{the second maximum gray level the second minimum gray level})} + \text{the second threshold}.$$

[c7] 7. The method of claim 1, wherein in step (d), the first gain value is:
$$\frac{(\text{the third mean gray level})}{(\text{the first mean gray level the$$

first minimum gray level); and
the second gain value is:
(the fourth mean gray level the second threshold) / (the
second mean gray level the second minimum gray level).

[c8] 8.The method of claim 1, wherein step (e) comprises multiplying the difference between the original gray level of pixels being less than the second threshold and the first mean gray level with the first gain value, and then adding the third mean gray level to generate adjusted image data gray levels for pixels less than the second threshold; multiplying the difference between the original gray level of pixels being greater than the second threshold and the second mean gray level with the second gain value, and then adding the fourth mean gray level to generate adjusted image data gray levels for pixels greater than the second threshold; and combining the adjusted image data gray levels for pixels less than and greater than the second threshold to generate adjusted gray levels for the image data.

[c9] 9.The method of claim 1, wherein the first threshold is input from a user interface.

[c10] 10.The method of claim 9, wherein the first threshold is the product of a threshold input from the user interface multiplied by a first weighting factor added to the prod-

uct of a mean gray level of all the pixels of the original image data multiplied by a second weighting factor.

- [c11] 11.The method of claim 10, wherein the sum of the first weighting factor and the second weighting factor is 1.
- [c12] 12.The method of claim 1, further comprising generating final adjusted image data gray levels by adding the product of the original image data gray levels and a third weighting factor to the product of the adjusted image data gray levels generated in step (e) and a fourth weighting factor.
- [c13] 13.The method of claim 12, wherein the sum of the third weighting factor and the fourth weighting factor is 1.
- [c14] 14.The method of claim 1, further comprising the following steps:
 - (f)providing a third gray level range and a fourth gray level range; according to the plurality of pixels in the image data being within the third gray level range, generating a fifth mean gray level, a third minimum gray level, and a third maximum gray level; and according to the plurality of pixels in the image data belonging to the fourth gray level range, generating a sixth mean gray level, a fourth minimum gray level, and a fourth maximum gray level; wherein the boundary between the third

gray level range and the fourth gray level range is a third threshold;

(g) according to the third threshold, generating a fourth threshold; according to the fourth threshold, the fifth mean gray level, the third minimum gray level, and the third maximum gray level, generating a seventh mean gray level; and according to the fourth threshold, the sixth mean gray level, the fourth minimum gray level, and the fourth maximum gray level, generating an eighth mean gray level;

(h) according to the seventh mean gray level, the fifth mean gray level, and the third minimum gray level, generating a third gain value; and according to the eighth mean gray level, the sixth mean gray level, and the fourth minimum gray level, generating a fourth gain value; and

(i) according to the fifth mean gray level, the third gain value, the seventh mean gray level, the sixth mean gray level, the fourth gain value, and the eighth mean gray level, generating adjusted image data gray levels for the third gray level range and the fourth gray level range.

[c15] 15. An image processing system using the method of claim 1.